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**APPLICATION FOR UNITED STATES PATENT**

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Title: HOLDER FOR DIGITAL SENSORS FOR DENTISTRY  
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**SPECIFICATION**

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## **Holder for Digital Sensors for Dentistry**

### **Field of the Invention**

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The present invention refers to a holder set for digital sensors for dentistry, each holder of the set comprising at least one displaceable arm.

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### **Background of the Invention**

Until lately, radiographs have been recorded on X-ray films that have been exposed and subsequently developed. Since X-ray films of this kind have determined standard formats, the sizes of the holders resp. of the clamping portions intended for receiving the X-ray films are standardized too. Up to now, the main problem with regard to such X-ray film holders has been to enable radiographs of the bitewing and of other areas of the teeth with a minimum number of different holders, while the film formats are mostly clamped either transversely or longitudinally.

Recently, a new imaging technique has been developed where digital image sensors are directly connected to a computer by a cable in order to directly display or store the radiographs on the latter.

In contrast to X-ray films, the different digital sensor products have different dimensions with regard to length and width and to thickness. Moreover, sensors of this kind comprise a cable, thereby making the correct positioning of such sensors problematic.

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### Prior Art

A number of sensor holders are already known, e.g. according to US-A-6,203,195, disclosing a sensor holder whose holder  
5 arm is extensible to enable the retention of different formats. Although it is already suggested here to use different formats, the universal application of this holder is limited by its construction.

10 WO/49 945 discloses another sensor holder where a holder arm is extensible for attaching sensors of different dimensions. Here also, the construction does not allow the universal application of the most diverse sensors.

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### Summary of the Invention

On the background of this prior art, it is the object of the present invention to provide a set of sensor holders that  
20 allows radiographs with all of the available digital sensors in the area of the anterior teeth and in the lateral area, i.e. in the periapical tissue, as well as horizontal and vertical bitewing images, while providing a good positioning, on one hand, and maximum comfort for the  
25 patient, on the other hand. This object is attained by a holder set wherein for each kind of radiograph such as periapical radiographs and radiographs of lateral and anterior teeth, on one hand, and bitewing radiographs, on the other hand, a respective holder is used for all sensor  
30 formats, the sensors being seized in the respective holders in a self-centered manner by two arms independently of their format, and by a holder set wherein for each kind of radiograph such as periapical radiographs and radiographs of lateral and of anterior teeth, a respective holder is used  
35 for all sensor formats, the sensor clamp comprising a

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clamping jaw for pressing the sensor against grippers independently of its format. The further claims indicate respective preferred embodiments.

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### **Brief Description of the Drawings**

The invention will be explained in more detail hereinafter with reference to drawings of exemplifying embodiments.

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Fig. 1 shows a first exemplifying embodiment of the clamping portion of a holder intended for periapical radiographs;

15 Fig. 2 shows a detail of the clamping portion of Fig. 1;

Fig. 3 shows the clamping portion of Fig. 1 with a vertically disposed sensor;

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Fig. 4 shows a second exemplifying embodiment of a clamping portion for a holder intended for bitewing images without the cover;

25 Fig. 5 shows the clamping portion of Fig. 4 viewed from the opposite side;

Fig. 6 shows a partly sectioned view of another exemplifying embodiment of a clamping portion for a holder intended for periapical images;

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Fig. 7 shows the clamping portion of Fig. 6 in a side view; and

35 Fig. 8 shows a detail of Fig. 6.

### Description of Preferred Embodiments

5 Figs. 1 to 3 show a first exemplifying embodiment of a  
sensor clamp of a holder where the two arms with the  
retaining strip are moved in a self-centering manner. Sensor  
clamp 1 of holder 2 comprises two arms 3 and 3A that are  
hinged on respective axles 4 and 4A and comprise respective  
10 angled levers 5, 5A actuated by a camshaft 6 in such a  
manner that the levers are pivoted down in Fig. 2 and the  
arms are thus swung inwards. The camshaft is under the  
action of a locking lever 7 for unlocking the arms, whereby  
they are swung to the open position. The camshaft and the  
15 levers are arranged in an enclosure 8.

This holder is particularly suitable for periapical  
radiographs of the anterior teeth, and it appears in Fig. 3  
that the digital sensor 9 with cable 10 is laterally clamped  
20 and the arms are designed such that little space is required  
laterally. Furthermore, it appears in Fig. 3 that the  
sensor clamp does not project beyond sensor 9.

Figs. 1 or 3 show a portion 11 of holder 2 whose  
25 constructive principle is similar to that of the holder  
according to EP-B-397 599. Thus, both the bite piece and  
the cranked indicator rod are the same or similar as in the  
cited European Patent while the spring-actuated X-ray film  
clamp has been replaced by the clamping portion 1 of Fig. 1.

30 Figs. 4 and 5 illustrate a holder for bitewing radiographs  
including a sensor clamp instead of the x-ray clamp. X-ray  
film holders for bitewing radiographs are known in the art  
and have been marketed for a long time by the applicant of  
35 the present invention, amongst others. Therefore, the parts

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that are not or not completely illustrated in Figs. 4 and 5, such as the cranked indicator rod, are not described in more detail. In analogy to the sensor clamp according to Figs. 1 to 3, the arms also move symmetrically, so that the sensor  
5 is always aligned to the indicator rod resp. to the X-ray tube in the same way independently of the dimensions of the sensor.

In Fig. 4, sensor clamp 12 is illustrated without its cover  
10 and schematically, and the two arms 13 and 13A with grippers 14 and 14A are visible. The arms are followed by curved portions provided with toothed racks 15 and 15A, the two toothed racks meshing with each other. Furthermore, in Fig. 4, a part of indicator rod 16 is visible. The movement of  
15 the toothed racks is influenced by a catch 17, the catch being self-locking so that the arms remain in any position they have attained. Moreover, the catch comprises a restoring spring 18, whereby one end of the catch is constantly acting upon one of the curved toothed racks, thus  
20 providing the self-locking action. The catch turns on pivot 19.

The solution using curved toothed racks allows a very slim design of the entire spreading and locking mechanism,  
25 thereby allowing a very slim design of bite piece 20, which is formed by the enclosure of the mechanism, see Fig. 5, so that the entire holder is more comfortable for the patient than anterior holders. The arms, resp. the clamping jaws with the grippers are so designed that they may accommodate  
30 any sensor geometry, i.e. they have a prismatic shape, as appears clearly in Fig. 5.

In a variant of the embodiment, rubber pads 21 are plugged onto grippers 13, 13A. For this purpose, it is useful if

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the grippers have a structure whereby such rubber pads are retained.

In Figs. 6 to 8, a second embodiment of a periapical sensor holder for posterior teeth (lateral teeth) is illustrated where the sensor is clamped from the bottom up instead of being seized laterally as in the preceding exemplifying embodiments.

10 Sensor clamp 22 may be mounted on the same holder as in the preceding examples, i.e. the plate is mounted directly adjacent the bite piece. The sensor clamp comprises a wall 23 provided with two integrally formed grippers 24, 24A intended for the retention of the sensor. In the lower  
15 portion of the clamp, a clamping jaw 25 is arranged which is upwardly displaceable according to arrow 26 in order to clamp the sensor. A locking knob 27 is provided on locking portion 28, the latter comprising an inclined plane 29 that actuates another inclined plane 30 of clamping jaw 25.

20 As locking portion 28 is moved from the right to the left in the drawing, the clamping jaw is pushed upwards. As shown in Fig. 8, both inclined planes 29 and 30 are provided with small teeth 31 inhibiting any movement of the two inclined  
25 planes on each other such that the clamping jaw always remains in the adjusted position. The self-locking mechanism is released by an opening motion in which the adhesion is overcome. This clamping mechanism is space-saving, so that the holder is slim and does not disturb.

30 Fig. 7 further shows that this sensor clamp may be arranged on a holder of the prior art instead of the usual film clamp. A part of indicator rod 33 appears in the illustration of holder 32. The clamping mechanism is  
35 accommodated in an enclosure 34.

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All sensor clamps of the invention have in common that they allow a problem-free and precise retention of the digital sensors with hygienic pouches or other protective envelopes  
5 and that no other plastic materials are present between the sensor and the X-ray tube. Also, as clearly follows from the description, they allow the retention of sensors of all dimensions. It further follows from the description that the sensors are always seized rather than being pushed into  
10 the clamp as the arms can always be opened to receive the sensor and subsequently retain it.

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